Working Paper 65

IMPACT OF DROUGHT ON AGRICULTURE: SOME OBSERVATIONS

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Agriculture is the mainstay of the approximately 70 per cent of the countries population and even now its nearly 70 per cent of the cropped area is exposed to the vegaries of monsoon. Almost the entire cotton crop and bulk of rice pulses and oilseeds crops are cultivated under the rainfed conditions.[1] The large scale fluctuations in rainfall both in quantum and time result in occurrence of drought. The rainfall may be interspered with prolonged periods of dry spells. It may not be sufficient to meet the requirements of crops. The rainfall may be so scanty that the soil moisture reserves may not be replenished but rather get depleted and become completly inadequate to support any plant growth.[2] Thus, the nature of rainfall has very significant impact on Indian agriculture and it is, therefore, aptly been stated that a drought in India means a lockout in agriculture industry.[3]

Identification of Drought

The drought occurrence and its severity has been measured in different ways by different organisations. The Irrigation Commission has defined drought as a situation in an area when the rainfall is less than 75 per cent of the normal. When the rainfall shortage is between 25 to 50 per cent, the

nature of the drought may be called moderate. The nature of the drought may be severe when the rainfall deficiency is above 50 per cent of the normal. The National Commission on Agriculture has defined drought when the rainfall in a week is half of the normal or less when weekly normal rainfall is 5 mm or more. On this criterion, drought can occur in two ways; (a) the rainfall less than 10 mm in a month, and (b) absence of rainfall in a period of four consecutive weeks.

Most of the State Governments use the Annawari method of identifying drought and its severity. Annawari is a system to estimate the conditions of crops by visual assessment in terms of yield in the ratio of annas to rupee. The scarcity is declared only when the production is less than 50 per cent of normal. The identification of drought during pendency of cropping season is done only by usual inspection at the end of harvesting. However, the crop cutting experiments are conducted by a committee consisting of a representatives from the district and also of local level. The yield of that particular year is juxtaposed to normal yield which is an average of ten years yield.

The Case Studied

The Hamirpur district which is one of the six drought prone districts of Uttar Pradesh was purposely selected for this study because the nature of rainfall in the district is erratic and rivers are seasonal in character. Consequently,

the surface and ground water availability in the district is of lower order. The lower availability of ground and surface water has resulted into the low level of irrigation in the district where only 16.97 per cent was net irrigated area of the net area sown during 1980-81. Moreover, there exists wide gap between the irrigation potential created and its utilisation in the district. The total irrigation potential created in the district was 1.22 lakh hectares in 1976-77 which increased to 1.80 lakh hectares during 1980-81, showing the growth of 47.50 per cent, whereas the utilisation of total created potential increased from 84 thousand hectares to about 86 thousand hectares, showing the growth of 2.38 per cent only. Besides, the existing irrigation potential of the district is still untapped to a very large extent as in the case of ground water, 76 per cent of the utilisable ground water is still available for tapping, besides surface water.

Thus, the erratic nature of rainfall alongwith low availability and utilisation of ground and surface water, the district is drought prone. With the result, there is loss of not only agricultural production but also of the fixed and flexible property, human and livestock population etc. But owing to data constraints, the efforts have been made here to assess and analyse the impact of drought on agriculture only.

Objectives

The main objectives of the study are:

(i) To assess the impact of drought on area, production and productivity of different crops viz. foodgrains, sugarcane and potato.

(ii) To examine whether the advancement made in agricultural development during last decades (the Green Revolution and onwards period) has minimised the impact of drought on agriculture.

(iii) To examine the existing criteria being followed by the State Government for declaring drought year in the district.

(iv) To suggest suitable policy measures to deal with the problem of drought in drought prone districts.

Methodology

Thus, an assessment of the impact of drought on agriculture for different drought years of the Hamirpur district, declared by the State Government, has been made by comparing the actuals of area, production and productivity of a particular drought year with the normals of area, production and productivity where normals are defined as mean values of the time series data (1950-51 to 1980-81) of area, production and productivity separately for two sub-periods i.e., pre-Green Revolution period and post-Green Revolution period. This division has been made just to accommodate in analysis the technological changes introduced in Indian agriculture during the period of Green Revolution and onwards.

The district of Hamirpur was declared drought affected by the U.P. Govt. in the years 1950-51, 1957-58, 1959-60, 1962-63, 1963-64 and 1964-65 in the pre-Green Revolution period and 1965-66, 1966-67, 1972-73, 1973-74, 1974-75, 1975-76, 1976-77 and 1979-80 during the post-Green Revolution period. The loss in agriculture is measured in terms of area, production and productivity of total foodgrains, sugarcane and potato which is shown in the following table and the impact thus, arrived at is as follows:

Impact on Area, Production and Productivity of Crops

It would be evident from the table that out of the 14 declared drought years, only 7 years in foodgrains, 9 years in sugarcane and 6 years in potato experienced loss in cultivated area. Similarly, 10 years in foodgrains, 8 years in sugarcane and 7 years in potato experienced production loss, whereas the number of years experiencing loss in productivity were 10 years in foodgrains, 8 years in sugarcane and 10 years in potato. The nature of drought is found to be most severe in the year 1966-67, followed by 1979-80, 1957-58, 1950-51, 1965-66 and 1974-75.

Thus, it becomes evident that in some years, there was a decline in area and production but the productivity showed a significant improvement and in some years the cultivated area declined whereas the production increased. This appears to be sensible also because during drought years farmers in

Table 1

Impact of Drought on Agriculture in Respect of Foodgrains, Sugarcane and Potato

Percentage

Period/ drought	Foodgrains			Sugarcane			Potato		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
0	1	2	3	4	5	6	7	8	9
1950-51*	-10.12	-23-37	-14.71	+30.92	+11.76	-14.63	-16.76	-17.80	- 1.25
1951-52	-11.43	- 8.93	+ 2.83	-32.73	-42.67	-14.77	-60.83	-60.42	+ 1.05
1952-53	- 7.85	-11.87	- 3.54	+17.32	- 7.41	-21.07	- 0.44	+ 6.79	+ 7.26
1953-54	- 6.37	- 3.10	+ 3.54	-43.52	-49.16	- 9.97	-72.25	-70.73	+ 5.51
1954-55	- 3.79	+11.33	+15.70	-23.85	-30.75	- 9.05	-72.25	-77.52	-18.97
1955-56	- 2.91	- 2.67	+ 0.28	+89.26	-59.30	- 5.82	-51.04	-44.50	+13.36
1956-57	- 1.29	+21.36	+23.06	+22.99	+50.78	+11.38	-28.19	-23.19	+ 6.97
1957-58*	- 2.09	-14.06	-12.16	-50.25	- 6.97	-24.36	- 2.07	-10.54	- 8.64
1958-59	+ 5.04	+13.36	+11.03	-41.27	-59.05	-17.67	+14.25	+20.84	- 5.77
1959-60*	+ 5.04	+ 5.67	+ 0.57	-41.27	-50.45	+15.62	+38.73	+84.31	+32.86
1960-61	+ 9.04	+23.35	+13.15	- 8.89	+37.40	+50.82	+38.73	+59.95	+15.30
1961-62	+ 7.85	+ 2.26	- 5.23	+22.74	+12.65	- 8.22	+56.68	+22.72	-50.67
1962-63*	+ 5.35	-10.86	-15.42	+17.62	+38.72	+17.94	+51.79	+42.86	- 5.88
1963-64*	+ 6.79	- 5.56	-11.46	-32.97	-24.10	+13.26	+20.78	-20.40	-33.88
1964-65*	+ 9.36	+ 2.05	- 6.65	- 2.61	+59.95	+64.25	+82.80	+32.79	+27.35
Combined	+ 2.39	- 7.69	- 9.48	- 0.89	+ 4.82	+ 5.78	+29.21	+35.25	+ 4.69

Contd...

Table 1 (contd..)

0	1	2	3	4	5	6	7	8	9
1965-66*	- 1.64	- 7.20	- 5.58	+74.29	+47.88	-15.13	-11.83	-31.17	-21.90
1966-67*	- 7.17	-41.25	-36.71	- 8.91	-40.88	-35.08	-43.06	-70.42	-48.03
1967-68	+ 3.50	+ 7.95	+ 4.26	-55.13	-55.87	- 1.65	-10.91	-31.17	-22.70
1968-69	+ 2.05	- 5.60	- 7.49	- 4.13	- 0.95	+ 3.34	-24.91	- 0.05	-19.95
1969-70	- 0.88	+11.26	+ 9.54	+43.91	+ 2.83	-28.53	-29.28	-51.37	-31.21
1970-71	- 0.89	+15.49	+16.59	+19.11	+11.75	+ 0.56	- 6.32	-26.40	-21.41
1971-72	- 1.08	+14.80	+16.15	- 7.51	+23.52	+33.39	+ 2.87	-17.49	-19.76
1972-73*	+ 2.53	+41.93	+38.47	+ 3.81	-11.98	-15.19	+ 3.78	-17.57	-20.54
1973-74*	+ 2.48	-11.49	-13.66	+24.75	- 3.07	-17.36	-12.75	-31.63	-21.61
1974-75*	- 4.09	-26.55	-23.64	- 2.04	+16.54	-14.79	+55.22	+37.97	-11.07
1975-76*	- 3.06	+10.27	+ 7.49	-32.42	-28.84	+ 5.33	+ 2.87	+15.39	+122.23
1976-77*	- 1.79	- 0.18	+ 1.62	-31.13	- 4.40	+38.84	+ 3.78	+13.24	+ 9.15
1977-78	- 0.42	+14.25	+14.68	+15.14	+68.59	+46.46	+31.34	+123.56	+28.16
1978-79	+ 2.02	+16.15	+13.80	+40.85	+70.84	+21.23	+38.68	+82.76	+31.84
1979-80*	+ 3.18	-48.86	-50.51	-30.86	-46.44	-22.51	-43.06	+45.15	- 3.63
1980-81	+ 2.78	+29.58	-26.14	-49.38	-30.58	+37.19	-63.19	+49.50	+59.65
Combind	- 1.19	-23.42	-22.17	- 0.34	-12.27	-11.98	- 5.63	-16.17	-11.13

Note : (1) The years with star marks represent drought years declared by the State Government in the district.

(2) Minus (-) indicates percentage loss to normals, whereas plus (+) denotes the percentage gains.

Source: Bulletin of Agricultural Statistics, Directorate of Agriculture, Uttar Pradesh, Lucknow.

general, make concerted efforts to make intensive use of cultivation on those pieces of land which are adequately served with assured means of irrigation. This enables them to make the maximum possible use of improved seeds, fertilizers and pesticides, finally resulting in higher production and productivity.

Green Revolution and Drought

The above table also reveals that the frequency of drought in terms of number of declared drought years was much less (six years) in the Pre-Green Revolution period (1950-65) as compared to the period of Green Revolution and onwards (1965-81) during which the frequency of declared drought years was relatively higher (eight years). Consequently, on an average, the loss in agriculture is found to be of lower order in the former period as compared to the latter one. In its support, we observe that the loss of area in respect of foodgrains, sugarcane and potato during the latter period was respectively 1.19 per cent, .34 per cent and 5.63 per cent of their respective normal areas. Contrary to this, in the former period we find that there was a gain in terms of area in respect of foodgrains and potato crops by 2.39 per cent and 29.21 per cent of their normals respectively, and a loss of hardly one per cent of area in case of sugarcane.

Moreover, the loss of production in respect of foodgrains, sugarcane and potato during the latter period is also found to be of the order of 23.42 per cent, 12.27 per cent and 16.17 per cent respectively, whereas in case of the former period, the corresponding loss of production was to the tune of 7.69 per cent in respect of foodgrains but the gains of 4.82 per cent and 35.25 per cent in case of sugarcane and potato respectively.

Besides, the loss of productivity in respect of foodgrains, sugarcane and potato during the latter period was estimated to be 22.17 per cent, 11.98 per cent and 11.13 per cent respectively but in case of the former period the corresponding loss of 9.48 per cent was experienced in case of foodgrains but the gains of productivity in respect of sugarcane and potato by 5.78 per cent and 4.69 per cent respectively.

In the above context, it appears that adoption of seed-fertilizer-irrigation technology during the Green Revolution period has not proved to be effective in minimising the affect of drought on agriculture in the district. In fact, the adoption of aforesaid modern technology primarily rests upon the availability and use of irrigation facilities. In case of Hamirpur district, we find that in spite of the appreciable increase in major and minor irrigation sources, the utilisation of the irrigation potential thus created is quite low (47.62 per cent). With the result, the irrigation coverage remained almost constant at about 17 per cent during the previous decade inhibiting more and more use of the other agricultural inputs.

Need for Different Criteria

The criteria being followed by the State Government for assessing the impact of drought on agriculture and thus declaring drought years, however, suffers from the defect that the ultimate loss can be assessed only after the crop cutting experiments, generally done at the end of the crop cutting seasons. Unfortunately, the assessment of losses largely depend upon the visual inspections and personal judgements of the Officers who matter. There is no scientific tools to assess the loss at different stages of crop growth. With the result, as is evident from the table, some years like 1951-52, 1952-53, 1953-54, 1954-55, 1955-56, 1956-57, 1958-59, 1960-61, 1961-62 in the pre-Green Revolution period and 1967-68, 1968-69, 1969-70, 1970-71, 1971-72, 1977-78 and 1980-81 in the post Green Revolution period were not declared drought years by the State Govt. in the district, although the impact of drought is evident on agriculture.

It is, therefore, essential to assess the impact of drought at different stages of crop growth. For a scientific assessment of drought and its impact, it is extremely essential to analyse the symptoms causes and effects of drought extensively.[4] If one or more indicators are accepted as determinants of drought, then its impact should be assessed tehsil/block-wise in the districts. As the inter tehsil/block level variations in the level of agricultural development are most marked in all the districts of the country, the criteria, thus,

followed will really identify the areas affected by drought and the relief operations could be oriented to such areas which are hit by the drought in a particular district.

Conclusions

The district numbering 201, covering an area of 1943 million hectares and accounting for 67.6 per cent of the total cropped area of the country constitute the drought prone area. Agriculture is the mainstay of the majority of the population which faces the twin problems of low productivity and instability. Crops often fail due to the inadequate and erratic nature of rainfall leading to unemployment and causing misery to the people and government.[5] Therefore, the augmentation of agricultural productivity in drought prone areas on one hand and search for additional employment and income opportunities on the other hand assume an urgent socio-economic necessity. Some of the important elements which may constitute a strategy for minimising the impact of drought in these areas are listed below:[6]

1. Development and Management of irrigation sources.
2. Soil and moisture conservation and afforestation.
3. Restructuring of cropping pattern and pasture development.
4. Development of small-marginal farmers and agricultural labourers.
5. Animal husbandry development.

The above task envolves a distinct and deliberate reversal of the trends which have persisted in these areas. The land use planning requires overall change just to avoid the cultivation of marginal and sub-marginal land. If the land use pattern is so restructured and the allied activities like animal husbandry are encouraged, the aforesaid strategy can provide, in a better way, the additional employment and income opportunities during drought years in these areas.

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